C-reactive protein on postoperative day 1: Significant predictive marker for early organ space surgical-site infections after bariatric

D. Kröll, M.D.

University Obesity Centre Bern

Department of Visceral Surgery and Medicine, Inselspital Bern

UNIVERSITÄT BERN

Disclosure

- Nothing to disclose

Background I

- Intra-abdominal infections (IAI) impact significantly the short- and long-term outcome
- C-reactive protein (CRP) levels have been proven to be accurate in a similar setting (colorectal surgery)
- Limited data are available on the use of CRP for complications after bariatric surgery
- Evidence exists that CRP levels on postoperative day (POD) 2 is a good predictor for major complications

Jacobsen et al. 2015, BJS

Adamia et al. 2015, BJS

Background I

- Intra-abdominal infections (IAI) impact significantly the short- and long-term outcome
- C-reactive protein (CRP) levels have been proven to be accurate in a similar setting (colorectal surgery)
- Limited data are available on the use of CRP for complications after bariatric surgery
- Evidence exists that CRP levels on postoperative day (POD) 2 is a good predictor for major complications

Jacobsen et al. 2015, BJS

Adamia et al. 2015, BJS

Background II

- Complications often occurs after discharge (fast track)
- Predictive accuracy of clinical data and routine upper gastrointestinal swallow is of limited value
- Impact of CRP on POD 1 to predict major intra-abdominal infections is not clear

Williams et al. 2017 Obes. Surg.

Warschkow et al. 2012 J GI Surg.

Background II

- Complications often occurs after discharge (fast track)
- Predictive accuracy of clinical data and routine upper gastrointestinal swallow is of limited value
- Impact of CRP on POD 1 to predict major intra-abdominal infections is not clear

Williams et al. 2017 Obes. Surg.

Warschkow et al. 2012 J GI Surg.

Aim of the study

To assess the predictive capacity of CRP on POD 1 for early organ space surgical site infections (OS-SSI) after bariatric surgery

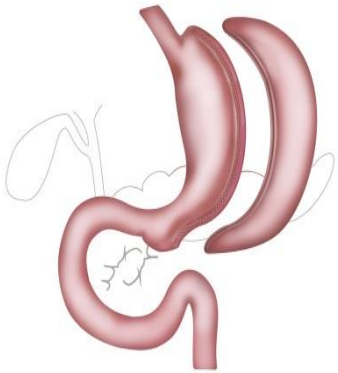
Objectives

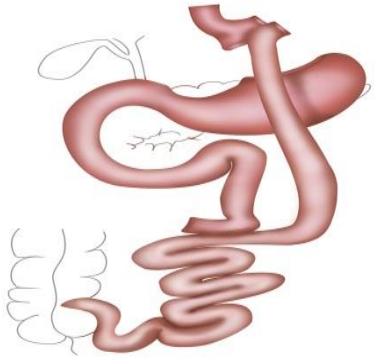
Primary objective

– To determine the ability of POD 1 CRP to predict early OS-SSI after LSG and RYGB

Secondary objectives

– To determine cut-off values for CRP on POD 1 for early OS-SSI





Methods I

- Retrospective review of a prospective bariatric cohort
- Patients who underwent primary LSG and LRYGB surgery between October 2010 and October 2016
- Determination of predictive capacity of CRP using receiver operating characteristics (ROC) and area under the curve (AUC)
- Determination of CRP cut-off value using Youden's index
- Univariate analysis using the CRP cut-off value on POD 1 (Fisher's exact test)

Methods I

- Retrospective review of a prospective bariatric cohort
- Patients who underwent primary LSG and LRYGB surgery between October 2010 and October 2016
- Determination of predictive capacity of CRP using receiver operating characteristics (ROC) and area under the curve (AUC)
- Determination of CRP cut-off value using Youden's index
- Univariate analysis using the CRP cut-off value on POD 1 (Fisher's exact test)

Method II

- SSI were assessed according to the guidelines of the US Centers for Disease Control and Prevention (CDC)
- Independent validation incidence of OS-SSI occurred through participation in SWISS NOSO
- Early OS-SSI within the first 7 days following surgery according to Csendes et al.
- CRP plasma levels reference range: less than 5 mg/l, range 0.3 to 700 mg/L (ISO17025 accredited laboratory)

Mangram et al., 1999, Am J Infect Control

Csendes et al., 2005, Obes. Surg.

Inclusion criteria

- Scheduled elective laparoscopic Roux-en-Y gastric bypass surgery or sleeve gastrectomy
- 18 years and older
- BMI ≥ 35 kg/m^2
- CRP value measured on POD 1

Exclusion criteria

- Previous bariatric procedure(s)
- Laparoscopic surgery with conversion to an open approach
- History of inflammatory or infectious diseases
- Use of antibiotics within two weeks prior to bariatric surgery

Baseline Characteristics

		all (n=494)	LSG (n=306)	LRYGB (n=188)
Age (years)		40 (20)	43 (20)	36 (17)
Female*		344 (69.6)	181 (59.2)	163 (86.7)
BMI (kg/m^2)		43.2 (8.2)	45.3 (9.5)	41.2 (5.5)
ASA score*	2	109 (22.1)	46 (15.0)	63 (33.5)
	3	380 (76.9)	255 (83.3)	125 (66.5)
	4	4 (1.0)	5 (1.6)	
Diabetes mellitus		112 (22.7)	91 (29.7)	21 (11.2)
Obstructive sleep apnea		190 (38.5)	146 (47.7)	44 (23.4)
Arterial hypertension		233 (47.2)	165 (53.9)	68 (36.2)
Dyslipidemia		213 (43.1)	146 (47.7)	67 (35.6)
Liver steatosis		239 (48.4)	161 (52.6)	78 (41.5)
Orthopedic disorders		286 (57.9)	176 (57.5)	110 (58.5)

Values are medians (interquartile ranges) unless indicated otherwise. *Values are numbers (percentages).
LSG: Laparoscopic Sleeve Gastrectomy, LRYGB: Laparoscopic Roux-en-Y Gastric Bypass, BMI: Body Mass Index, ASA: American Society of Anesthesiologists Physical Status Classification System

Incidence of early OS-SSI

- Early OS-SSIs were observed in 15 patients (3%)
  LSG 7 (2.3%), RYGB 8 (4.3%)
- The median interval from surgery to the onset of the OS-SSI was 2 days
- The overall median length of hospital stay was 3 days (range 2-33)
- The frequency of leak was not significantly correlated with sex, age, or comorbidities

Incidence of early OS-SSI

- Early OS-SSIs were observed in 15 patients (3%)
  LSG 7 (2.3%), RYGB 8 (4.3%)
- The median interval from surgery to the onset of the OS-SSI was 2 days
- The overall median length of hospital stay was 3 days (range 2-33)
- The frequency of leak was not significantly correlated with sex, age, or comorbidities

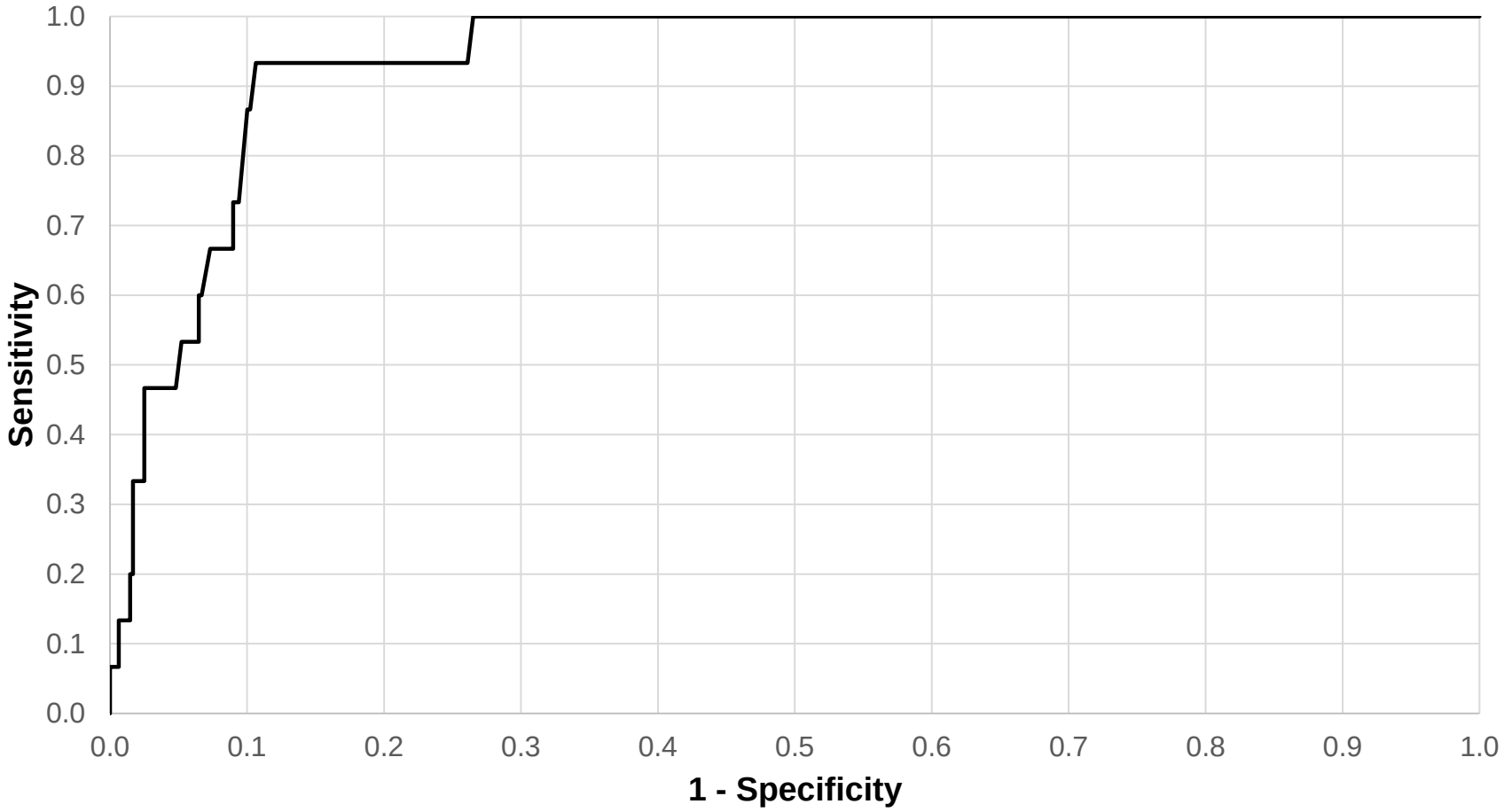
Median CRP values with & w/o early OS SSI

	Early OS SSI	No early OS SSI	p-value
All (n=494)	100 (72)	22 (30)	<0.001
LSG (n=306)	85 (77)	17 (14)	<0.001
LRYGB (n=188)	128 (67)	47 (49)	0.035

Univariate Analysis using Mann-Whitney test. Variables are medians(interquartile ranges). CRP: C-reactive protein (mg/L), OS: organ space, SSI: surgical site infection, LSG: Laparoscopic Sleeve Gastrectomy, LRYGB: Laparoscopic Roux-en -Y Gastric Bypass

LSG and LRYGB

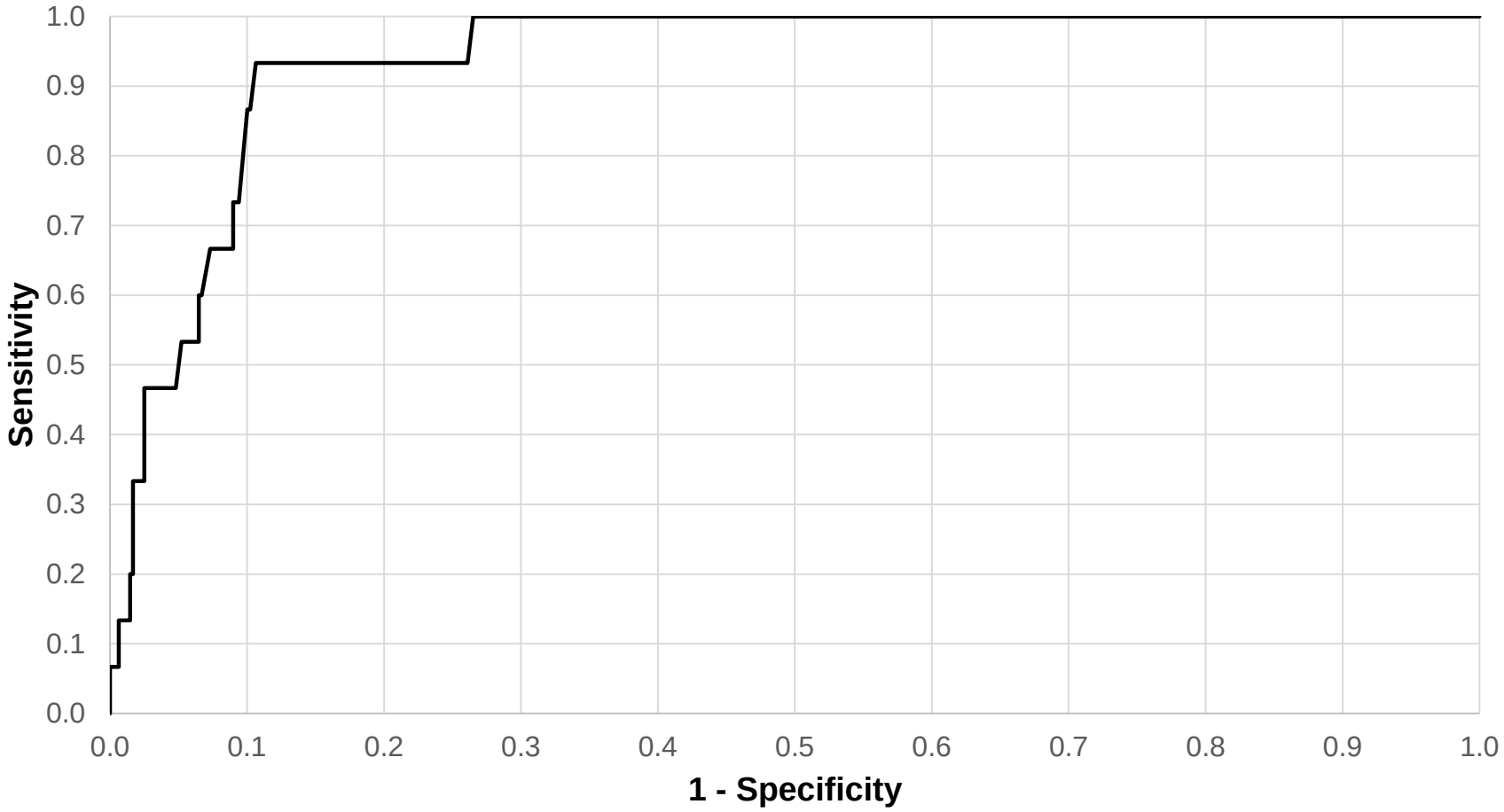
CRP on postoperative day 1 as a predictor for early organ space SSI



Receiver operating characteristics curve analysis
Area Under the Curve 0.937, 95% Confidence Interval 0.901-0.973, p<0.001
LSG: Laparoscopic Sleeve Gastrectomy; LRYGB: Laparoscopic Roux-en-Y Gastric Bypass

LSG and LRYGB

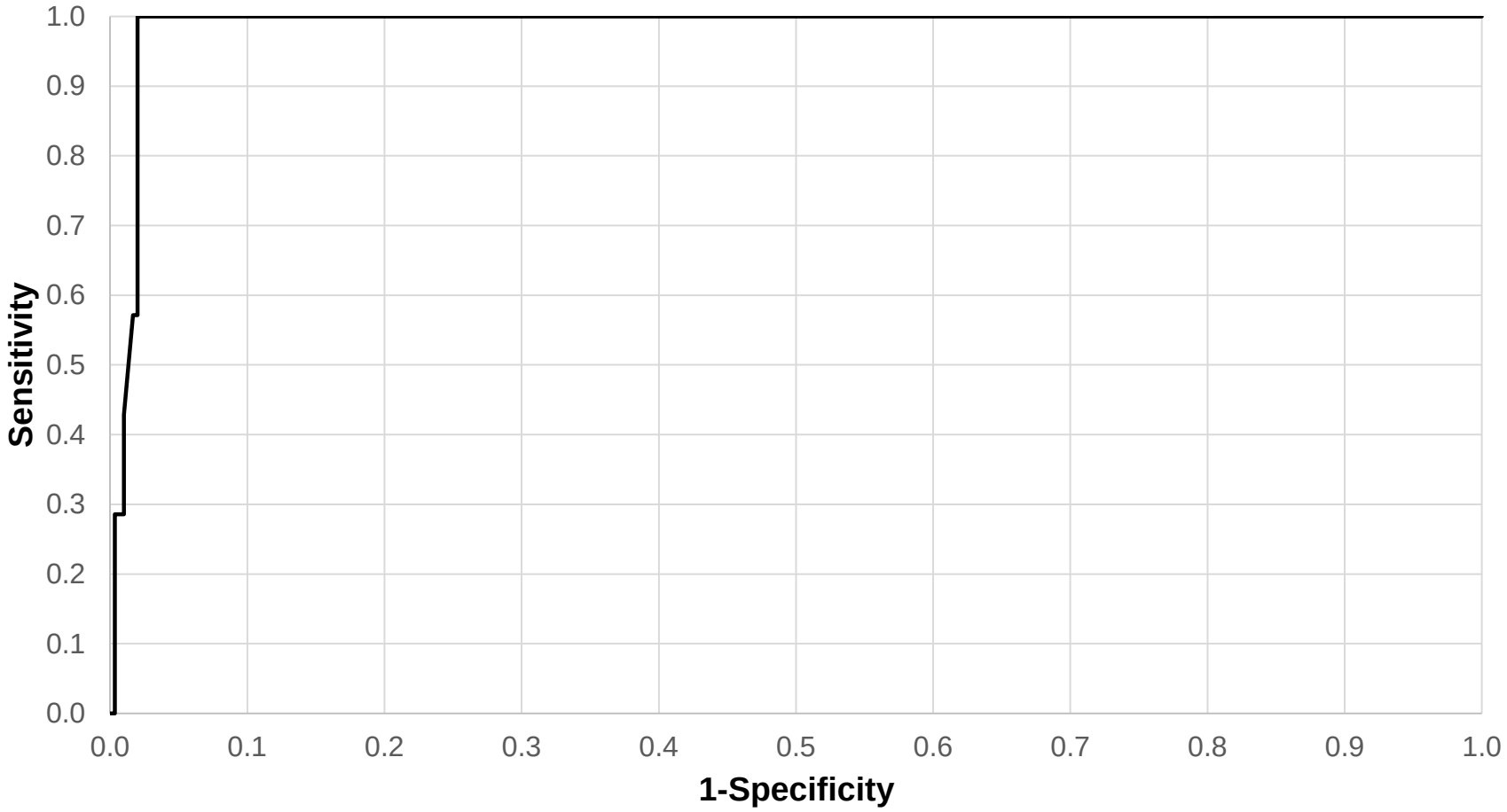
CRP on postoperative day 1 as a predictor for early organ space SSI



Receiver operating characteristics curve analysis
Area Under the Curve 0.937, 95% Confidence Interval 0.901-0.973, p<0.001
LSG: Laparoscopic Sleeve Gastrectomy; LRYGB: Laparoscopic Roux-en-Y Gastric Bypass

LSG

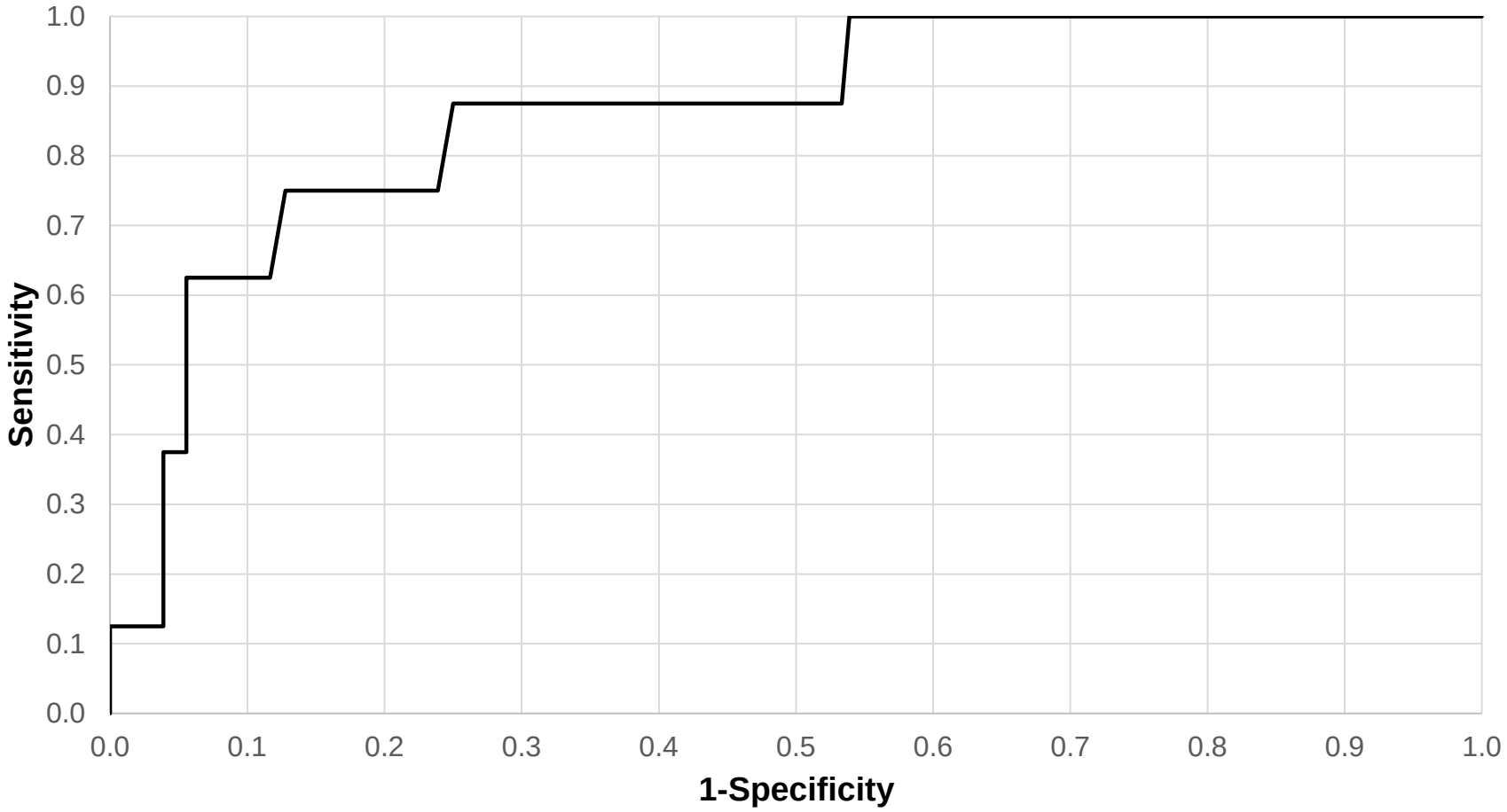
CRP on postoperative day 1 as a predictor for early organ space SSI



Receiver operating characteristics curve analysis
Area Under the Curve 0.987, 95% Confidence Interval 0.975-0.999, p<0.001
LSG: Laparoscopic Sleeve Gastrectomy

LRYGB

CRP on postoperative day 1 as a predictor for early organ space SSI



Receiver operating characteristics curve analysis
Area Under the Curve 0.864, 95% Confidence Interval 0.744-0.983, p=0.001
LRYGB: Laparoscopic Roux-en-Y Gastric Bypass

CRP day 1 ≥ 70 mg/L on POD 1

	AUC	95% CI	p-value	Sensitivity	Specifity	PPV	NPV
All (n=494)	0.937	0.901-0.973	<0.001	93%	88%	19%	100%
LSG (n=306)	0.987	0.975-0.999	<0.001	100%	98%	50%	100%
LRYGB (n=188)	0.864	0.744-0.983	0.001	88%	72%	12%	99%

Receiver Operating Characteristic Analysis
CRP: C-reactive protein, AUC: area under the curve, CI: confidence interval, PPV: positive predictive value, NPV: negative predicting value.

Predictive value of day 1 CRP for early organ space surgical site infection

	OS-SSI	<70 mg/L	≥70 mg/L	p-value
all n/n_{tot} (%)	15/494 (3.0)	1/422 (0.2)	14/72 (19.4)	<0.001
LSG n/n_{tot} (%)	7/306 (2.3)	0/292 (0.0)	7/14 (50.0)	<0.001
LRYGB n/n_{tot} (%)	8/188 (4.3)	1/130 (0.8)	7/58 (12.1)	0.001

Univariate Analysis using Fisher's exact test. Variables are numbers (percentages).
LSG: Laparoscopic Sleeve Gastrectomy, LRYGB: Laparoscopic Roux-en-Y Gastric Bypass, CRP: C-reactive protein (mg/L).

Conclusion

- CRP levels ≥70 mg/l on POD 1 is a significant negative predictor for early OS-SSI in bariatric patients

- may be a useful (additional) marker for early complications in patients within an enhanced recovery program (fast-track surgery)

Outlook

- Prospective validation of predictive value and cost effectiveness in fast track programs

Thank you

Limitations

- Retrospective study
- Single center study